

## WHAT IS CLAIMED IS:

1. A combined AC/DC monitoring system for simultaneously monitoring an AC power supply and a DC power supply in a mobile unit, comprising:

- 5        a transformer for electrically isolating the AC power supply from the combined AC/DC monitoring system and for providing an isolated, AC voltage signal to the combined AC/DC monitoring system;

AC voltage monitor input terminals connected to the isolated AC signal for monitoring the isolated AC voltage signal;

- 10       DC voltage monitor input terminals connected to the DC power supply for monitoring a DC voltage for the DC power supply;

a DC shunt, said DC shunt having a first terminal connected to a positive , non-grounded terminal of the DC power supply and said DC shunt having a second terminal;

- 15       a first DC current monitor input terminal and a second DC current monitor input terminal that are respectively connected to the first and to the second terminals of the DC shunt for measuring DC current from the DC power supply;

an analog-to-digital converter ADC system having respective input terminals connected to the AC voltage monitor input terminals, the DC voltage monitor input terminals, and the DC current monitor input terminals, wherein the ADC provides  
20       respective digital output signals indicative of instantaneous sampled values of the isolated AC signal, the DC voltage, and the DC current;

a microcontroller having input terminals for receiving respective digital output signals of the ADC, wherein said microcontroller digitally computes various respective computed variables from the respective digital output signals received from the ADC;

- 25       a visual display system that receives signals representative of the computed variables from the microcontroller and that simultaneously visually displays a plurality of pre-selected ones of the respective computed variables;

an alarm system that is selectively activated when a pre-selected computed variable is in a respective alarm condition that is outside (exceeds) a predetermined limit;

wherein the microcontroller provides user menus displayed on the visual display system and wherein the microcontroller has keypress terminals for receiving respective user control signals from user-operated switches that are operated by a user in conjunction with the user menus to control operation of the microcontroller, the visual display system, and the alarm system.

2. The combined AC/DC monitoring system of Claim 1 wherein the transformer for electrically isolating the AC power supply from the combined AC/DC monitoring system provides a lower-voltage isolated AC voltage signal to the monitoring system and wherein the lower-voltage isolated AC voltage signal is conformable to a safety code.

3. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include an AC RMS voltage.

4. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller includes input terminals for receiving signals indicative of AC current from the AC power supply and wherein the microcontroller provides a computed variable for AC current.

5. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include an AC frequency.

6. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include a computed variable that is indicative of the AC voltage being either a true sine wave or a modified sine wave.

7. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller is provided with an algorithm that computes a standard deviation of a computed variable for the isolated AC signal to determine whether the isolated AC voltage is a sine wave signal or a modified sine wave signal.

8. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include a DC voltage.

9. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include a DC current.

5 10. The combined AC/DC monitoring system of Claim 9 wherein the respective computed variable include DC ampere hours computed over a pre-selected time period.

11. The combined AC/DC monitoring system of Claim 1 wherein the DC power supply includes a battery.

12. The combined AC/DC monitoring system of Claim 11 wherein the DC power  
10 supply includes two batteries.

13. The combined AC/DC monitoring system of Claim 1 wherein the DC shunt is user selectable to provide a plurality of ampere/millivolt ratings.

14. The combined AC/DC monitoring system of Claim 1 wherein the visual display system includes a display screen.

15 15. The combined AC/DC monitoring system of Claim 1 wherein the visual display system that simultaneously visually displays a plurality of pre-selected ones of the respective computed variables includes a LCD display that is driven by the microcontroller.

16. The combined AC/DC monitoring system of Claim 1 wherein the alarm  
20 system includes an audible alarm.

17. The combined AC/DC monitoring system of Claim 1 wherein the alarm system provides an alarm control signal for operation of an external alarm system.

18. The combined AC/DC monitoring system of Claim 1 wherein the respective audible alarms are activated when a respective alarm condition exceeds a  
25 predetermined time period.

19. The combined AC/DC monitoring system of Claim 11 wherein the alarm system is not activated when a preselected computed variables is below a predetermined threshold values.

20. The combined AC/DC monitoring system of Claim 1 wherein the respective computed variables include, for monitoring rapidly changing respective computed variables, a high value of a respective computed variable and a low value of the respective computed variable.

5        21. The combined AC/DC monitoring system of Claim 20 wherein the microcontroller is provided with an algorithm that determines that the respective computed variable is rapidly changing over a predetermined period of time and that and that captures a local maximum and a local minimum value of the respective computed variable.

10        22. The combined AC/DC monitoring system of Claim 20, for monitoring voltage surges, wherein the high value of the computed variable and the low value of the computed variable are alternately displayed for predetermined time periods on the visual display system when the difference between the high and low values exceeds a predetermined percentage.

15        23. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller provides offset signals for various one of the respective computed variables.

24. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller provides gain constants for various ones of the computed variables.

20        25. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller provides a digital output signal indicative of temperature for display by the visual display system.

26. The combined AC/DC monitoring system of Claim 11 wherein the mobile unit is a recreational vehicle.

25        27. The combined AC/DC monitoring system of Claim 1 wherein the microcontroller, the display system, and the user-operated switches are packaged in a panel-mounted module.

28. A combined AC/DC monitoring system for a recreational vehicle that simultaneously monitors an AC power supply and a DC power supply and that display pre-selected computed variables, comprising:

a step-down isolation transformer for electrically isolating the AC power supply  
5 from the monitoring system and for providing an isolated, stepped-down AC voltage signal to the monitoring system;

AC voltage monitor input terminals connected to the isolated AC signal for monitoring the isolated AC voltage signal;

DC voltage monitor input terminals connected to the DC power supply for  
10 monitoring a DC voltage for the DC power supply;

a DC shunt, said DC shunt having a first terminal connected to a positive, non-grounded, terminal of the DC power supply and said DC shunt having a second terminal;

first and second DC current monitor input terminals respectively connected to the  
15 first and to the second terminals of the DC shunt for measuring current from the DC power supply;

an analog-to-digital converter ADC system having respective input terminals connected to the AC voltage monitor input terminals, the DC voltage monitor input terminals, and the DC current monitor input terminals, wherein the ADC provides  
20 respective digital output signals indicative of instantaneous values of the isolated AC signal, the DC voltage, and the DC current;

a microcontroller having input terminals for receiving respective digital output signals of the ADC, said microcontroller digitally computing various respective computed variables from the respective digital output signals received from the ADC;

25 a visual display screen that receives signals representative of the computed variables from the microcontroller and that simultaneously visually displays pre-selected ones of the respective computed variables;

an audible alarm that is selectively activated when a pre-selected computed variable is in a respective alarm condition that is outside a predetermined limit;

wherein the microcontroller includes keypress terminals for receiving from user-operated switches respective user control signals for operation of the microcontroller;

wherein the microcontroller provides user menus that are displayed on the display screen and wherein the microcontroller has keypress terminals for receiving  
5 respective user control signals from user-operated switches that are operated by a user in conjunction with the user menus to control operation of the microcontroller, the visual display screen, and the audible alarm; and

wherein the computed variables are selected from a group comprising: an AC voltage, an AC current, an AC r.m.s. voltage, an AC frequency, a DC current, a DC  
10 voltage, DC ampere hours, and temperature.

29. A method of simultaneously monitoring an AC power supply and a DC power supply for a mobile unit with a combined AC/DC monitoring system, comprising the steps of:

15 electrically isolating the AC power supply with a transformer and providing an isolated AC voltage signal to the combined AC/DC monitoring system;

coupling the isolated AC signal to AC voltage monitor input terminals for monitoring the isolated AC voltage signal;

coupling the DC power supply to DC voltage monitor input terminals for  
20 monitoring a DC voltage for the DC power supply;

for measurement of DC current from the DC power supply, connecting a first terminal of a DC shunt to a positive, non-grounded terminal of the DC power supply, connecting the first terminal of the DC shunt to a first DC-current monitor input terminal; and connecting a second terminal of the DC shunt to a second DC-current monitor  
25 input terminal;

coupling the AC voltage monitor input terminals, the DC voltage monitor input terminals, and the DC current monitor input terminals to input terminals of an analog-to-digital converter ADC system, and the ADC providing respective digital output signals

indicative of instantaneous sampled values of the isolated AC signal, the DC voltage, and the DC current;

receiving respective digital output signals of the ADC at input terminals of a microcontroller and said microcontroller digitally computing various respective computed  
5 variables from respective digital output signals received from the ADC;

a visual display system receiving signals representative of the computed variables from the microcontroller and simultaneously visually displaying a plurality of pre-selected ones of the respective computed variables;

selectively activating an alarm system when a pre-selected computed variable is  
10 in a respective alarm condition that is outside a predetermined limit;

the microcontroller providing user menus that are displayed on the visual display system;

the microcontroller receiving at keypress terminals respective user control signals from user-operated switches that are operated by a user in conjunction with the  
15 user menus to control operation of the microcontroller, the visual display system, and the alarm system.

30. The method of Claim 29 including the steps of:

disabling the alarm function by operating any user-operated switch;

20 if a computed value does not exceed a predetermined value, checking for a key press;

if a key is pressed and if the system is in a setup mode, setting user max/min values and enable/disable alarm;

if a key is pressed and if the system is in a configuration mode, setting advanced  
25 configuration parameters; and

if a key is pressed and if the system is in a display change mode, changing the display.